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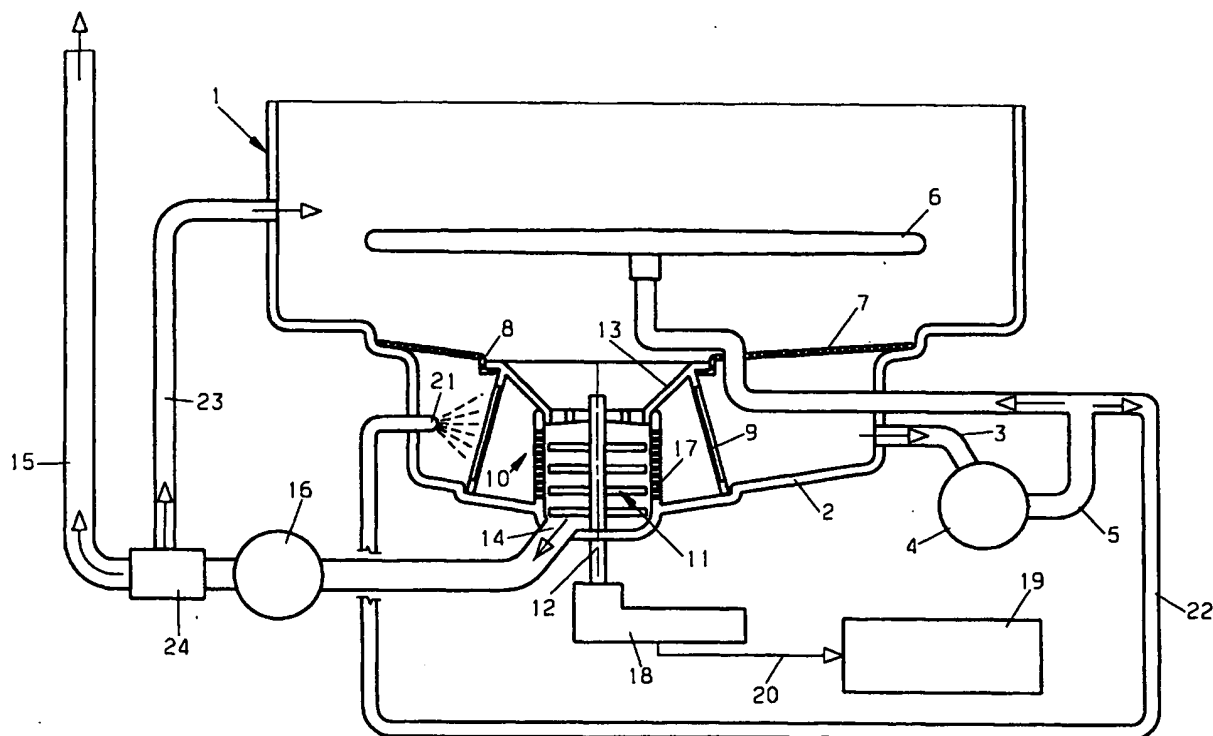
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(54) Dishwashing machine with garbage shredding apparatus

(57) The dishwashing machine comprises a built-in garbage shredder (10) that has a rotor (11) adapted to selectively rotate in the two opposite directions as driven by a bi-directional electric motor (18), which is

controlled by sensors (19) adapted to cause the rotor to reverse the direction of rotation thereof when the resisting torque applied to the same rotor is detected to exceed a pre-determined threshold value.



Description

[0001] The present invention refers to a dishwashing machine of the type incorporating a garbage shredder adapted to enable the soil being removed from the dishes and the other washload items in general to be cut into tiny particles under corresponding improvement in the performance and effectiveness of the filtering system and, ultimately, the entire dishwashing machine.

[0002] Garbage shredding apparatuses are generally known to usually comprise an array of knives adapted to rotate with respect to an array of stationary blades. As such, they are also generally known as being subject to jamming due to the presence of particularly hard soil matters, such as chicken bones or the like, which practically prevent them from operating in a correct manner.

[0003] This problem is of particularly great significance in dishwashing machines, in which, owing mainly to problems deriving from the need to reduce space requirements, the available power for driving the garbage shredding apparatus is relatively low, while particularly tough soil matters capable of causing the garbage shredding apparatus to jam are on the other hand quite frequently present inside such machines.

[0004] In view of minimizing the likelihood of a jamming of the rotating parts, a hydraulically operated garbage shredding apparatus has been proposed, such as the one that is for instance described in US-A-6 012 662. In this solution, an alternating piston is driven by water under pressure in an annular chamber and is connected to the rotating knives of the garbage shredding apparatus. A valve is provided with an alternating control piston so as to be able to selectively divert the water under pressure in said annular chamber on to opposite sides of the actuating piston. As a result, the rotating knives are operated so as to be capable to rotate in opposite directions, in particular when they happen to be jammed by particularly tough soil matters. Conclusively, it can therefore be said that the garbage shredder is capable of working effectively under any operating conditions.

[0005] On the other hand, however, a garbage shredder of the above described type is relatively bulky, ie. needs quite a lot of space, and requires a connection to a water supply line capable of supplying water at a particularly high pressure (as is the case in the USA, for instance). It in fact becomes practically ineffective if it is connected to a water supply line with a rather reduced supply pressure, eg. as this is the case in European countries.

[0006] In any case, a dishwashing machine incorporating a garbage shredder of this kind would unavoidably imply a really excessive water usage.

[0007] It therefore is a purpose of the present invention to provide a dishwashing machine incorporating a garbage shredding apparatus which is particularly effective, compact and adapted to favour a substantial energy saving effect.

[0008] A further purpose of the present invention is to

provide a dishwashing machine of the above cited kind, which is provided with a filtering system that is particularly simple, rational and effective, such as to be instrumental in substantially improving the washing performance capabilities of the dishwashing machine.

[0009] Another purpose yet of the present invention is to provide a dishwashing machine of the above cited kind, which is provided with a water circuit that is particularly adapted to boost the performance capabilities of the built-in garbage shredding apparatus.

[0010] According to the present invention, these aims are reached in a dishwashing machine with a built-in garbage shredding apparatus embodying the characteristics as recited and defined in the appended claims.

[0011] Anyway, features and advantages of the present invention may be more readily understood from the description that is given below by way of nonlimiting example with reference to the single accompanying drawing, which is a partial and schematic view of a preferred embodiment of the dishwashing machine according to the present invention.

[0012] With reference to said Figure, the dishwashing machine mainly comprises a washing vessel 1 (shown only partially) provided on its bottom portion with a water collecting sump 2, to which there is connected the suction side 3 of a circulation pump 4, the delivery side 5 of which is connected to at least a rotating spray arm 6 so as to spray washing liquor on to the washload items arranged in appropriate support racks (not shown for reasons of greater simplicity).

[0013] The washing vessel 1 also accommodates, below the rotating spray arm 6, a filtering system arranged in the flow-path of the washing liquor which, upon having been so sprayed on to the washload items, collects into the sump 2 in view of being taken in again by the circulation pump 4.

[0014] In the example being described here, said filtering system comprises a planar or frusto-conical, preferably coarse-mesh filter portion 7, which is provided with a mouth 8 between the edge of which and the bottom of the sump 2 there extends the main filter portion, which is generally indicated at 9 in the Figure.

[0015] The filter 9 has preferably a very fine mesh structure and is the section of the filtering systems that most of all contributes to the retention of the soil particles from the flow of the water circulated by the pump 4. The filter 9 has substantially a frusto-conical (as shown in the Figure, actually), cylindrical or a similar shape, and is adapted to be driven rotatably, substantially about its own main axis, by the rotor 11 of a garbage shredding apparatus which is incorporated in the dishwashing machine and is generally indicated at 10 in the Figure.

[0016] In a preferred manner, the garbage shredding apparatus 10 comprises knives capable of rotating with respect to an array of stationary blades of the type described in US-A-6 109 551.

[0017] The filter 9 is rotatably integral with a driving

shaft 12 of the rotor 11, to which it is connected through a frusto-conical flange 13 that forms for the garbage shredder 10 a kind of inlet hopper communicating with the washing vessel 1 upstream of the filtering system 7, 9.

[0018] The garbage shredder 10 also comprises an outlet aperture 14, preferably provided in the bottom of the water collecting sump 2, from which there branches off an outlet conduit 15 provided with a drain pump 16. In other words, the outlet conduit 15 of the dishwashing machine branches off the sump 2 in correspondence of the garbage shredder 10.

[0019] In a preferred manner, the garbage shredder 10 extends from the bottom of the sump 2 up to the inlet hopper 13 with a side wall that is substantially defined by an auxiliary coarse-mesh filter 17 that is substantially surrounded by the main filter 9, of which it advantageously limits the possibility of getting clogged.

[0020] Via the shaft 12, the rotor 11 of the garbage shredder 10 is connected to an electric-bi-directional motor 18, which is controlled by sensor means 19 adapted to either directly or indirectly detect the resisting torque applied to the rotor 11 and to cause the same rotor to reverse the direction of rotation thereof when the resisting torque is detected to exceed a pre-determined threshold value.

[0021] Said sensor means 19 may include a threshold-value comparator built into the programme sequence control unit of the machine (not shown in the Figure for reasons of greater simplicity, and comprising for instance a Motorola 68HC705 microprocessor) and driven by means of an input 20 with a signal that is indicative of the above mentioned resisting torque. Such a signal may for instance be the current absorbed by the motor 18, or the phase difference between the voltage and the current of the motor 18, or the like.

[0022] In any case, should it happen that the rotor 11 of the garbage shredder tends to become jammed due to the presence of a foreign matter that proves particularly tough and is apt to give rise to a resisting torque in excess of a pre-determined value, the sensor 19 causes (through the programme sequence control unit of the machine) the rotor 11 to reverse its direction of rotation, thereby ensuring a maximum extent of effectiveness in the operation of the garbage shredder 10.

[0023] Irrespective of this operational feature thereof, the rotor 11 is preferably driven by the motor 18 so as to be capable to regularly reverse its direction of rotation in a cyclic manner, eg. upon each complete revolution thereof.

[0024] In all cases, as already mentioned earlier in this description, the rotor 11 is arranged to rotatably drive also the filter 9, and the latter is associated to at least an adjacent stationary nozzle 21 connected to the delivery side 5 of the circulation pump 4 via a calibrated-bore branch-pipe 22. As a result, when the pump 4 is operating and the filter 9 is so driven to rotate, substantially the entire surface of said filter 9 is flushed by a

counter-flow jet of water, coming from said nozzle 21, which advantageously removes from, ie. flushes off the same filter the soil particles that are gradually retained by the same filter. It can be readily appreciated that such a rotation of the filter 9 enables an optimum self-cleaning effect of the same filter to be obtained, although making use of just a single nozzle 21 and, therefore, without any substantial additional water usage.

[0025] In a preferred manner, the outlet conduit 15 comprises, downstream of the drain pump 16, a flow-diverting device 24 from which a re-circulation pipe 23 communicating with the interior of the washing vessel 1 branches off. In a preferred manner, furthermore, such a diverting device 24 is normally in a condition in which the drain pump 16 is in communication with the sole outlet conduit 15.

[0026] At the beginning of an operating cycle of the dishwashing machine, eg. during a pre-wash phase (or, anyway, when coarse soil particles happen to be still deposited on the washload items), the programme sequence control unit of the machine determines the operation of the circulation pump 4 and the drive motor 18; it furthermore commands the diverter 24 to temporarily switch over to an operational position in which the delivery side of the drain pump 16, which is also operated temporarily, is in communication with the re-circulation pipe 23. As a result, the soil particles that are flushed off the washload items due to the action of the rotating spray arm 6 are shredded by the garbage shredder 10 and recirculated by the pump 16 through the pipe 23 that conveys them again into the washing vessel 1 and, then, again through the garbage shredder 10. In other words, in this temporary phase, the re-circulation pipe 23 enables a real closed-loop water-flow circuit, passing through the garbage shredder 10, to be realized for the soil particles conveyed by a flow of water generated by the drain pump 16, which therefore performs a twofold task.

[0027] This most advantageously enables the soil particles to be shredded most finely, and this in turn enables the dishwashing machine to subsequently carry out a washing phase (which may also be a substantially traditional one) under the best conditions in view of obtaining an ideal washing effect.

[0028] In an appropriate subsequent phase of the washing cycle being performed by the machine, the programme sequence control unit of the machine may of course cause the flow diverter 24 to switch back into its normal resting position, so as to enable the soiled water contained in the washing vessel 1 to be let off through the outlet pipe 15. The resulting absence of soil on the bottom of the washing vessel 1 brings about the quite important advantage that the subsequent washing, rinsing and/or drying phases of the cycle will be able to be carried out with completely clean water and in a substantial absence of bad odours.

[0029] As for the rest, the general operation of the dishwashing machine may be of a substantially tradi-

tional kind, so that it shall not be dealt with here any further for reasons of greater simplicity.

[0030] It shall be appreciated that the dishwashing machine that has been described here by mere way of example may be the subject of a number of modifications without departing from the scope of the present invention.

Claims

1. Dishwashing machine comprising a garbage shredding apparatus (10) that has an inlet in communication with the washing vessel of the machine and an outlet connected to an outlet conduit, said garbage shredding apparatus comprising in turn a rotor adapted to selectively rotate in the two opposite directions, **characterized in that** said rotor (11) is driven by a bi-directional electric motor (18), which is controlled by sensor means (19) adapted to detect the resisting torque being applied to the rotor of the garbage shredding apparatus (10) and to cause the same rotor to reverse the direction of rotation thereof when the resisting torque is detected to exceed a pre-determined threshold value.
2. Dishwashing machine according to claim 1, **characterized in that** said sensor means (19) comprise a threshold-value comparator driven by a signal that is indicative of said resisting torque, such as the current absorbed by said electric motor (18), the phase difference between the voltage and the current of the same motor, or the like.
3. Dishwashing machine according to claim 1, **characterized in that** the rotor (11) of said garbage shredding apparatus (10) is normally driven by said motor (18) so as to reverse its direction of rotation cyclically.
4. Dishwashing machine according to claim 1, comprising a filtering system arranged in the flow-path of the washing water circulated by a circulation pump, **characterized in that** at least a main portion (9) of said filtering system (7, 9, 17) is adapted to be rotatably driven jointly with the rotor (11) of the garbage shredding apparatus (10) and is associated to at least a nozzle (21), or the like, adapted to be supplied by said circulation pump (4) so as to issue a counter-flow jet of water capable of flushing and cleaning said portion (9) of said filtering system.
5. Dishwashing machine according to claim 4, **characterized in that** said nozzle (21) is connected to the delivery side (5) of the circulation pump (4) via a calibrated-bore branch pipe (22).
6. Dishwashing machine according to claim 4, **char-**

acterized in that said main portion (9) of the filtering system is substantially frusto-conical or cylindrical in its shape and is rotatably joined with said rotor (11) of said garbage shredding apparatus (10) so as to be capable of rotating, about its own main axis, integrally therewith.

7. Dishwashing machine according to claim 4, **characterized in that** said garbage shredding apparatus (10) has at least a wall that is substantially defined by an auxiliary filter (17), which is substantially surrounded by said main filter (9).
8. Dishwashing machine according to claim 1, **characterized in that** said outlet conduit (15) comprises, downstream of a drain pump (16), normally inoperative flow diverting means (24) adapted to selectively connect, during a temporary phase, the delivery side of said drain pump (16) with a re-circulation pipe (23) communicating with the interior of the washing vessel (1), in such a manner as to bring about a closed-loop water-carrying circuit, passing through said garbage shredding apparatus (10), for the soil particles being conveyed by a flow of water generated by said drain pump (16).
9. Dishwashing machine according to claim 8, **characterized in that**, upon conclusion of said temporary phase, the drain pump (16) is temporarily operated to let off, through said diverting means (24), water containing the soil particles that have previously been most finely shredded by said garbage shredding apparatus (10)

